Backup Of A Computer

This application is a continuation-in-part of:

U.S. Patent Application No. 09/862,898, entitled, "A Computer with Switchable Components," filed May 21, 2001, naming Kenneth Largman and Anthony B. More as inventors, with Attorney Docket No. A-70543/RMA/LM, and commonly assigned to Self Repairing Computers, Inc., San Francisco, California.

U.S. Patent Application No. (unknown), entitled, "On-The-Fly Repair Of A Computer," filed November 19, 2001, naming Kenneth Largman and Anthony B. More and Jeffrey Blair as inventors, with Attorney Docket No. A-70543-1/RMA/LM, and commonly assigned to Self Repairing Computers, Inc., San Francisco, California.

U.S. Patent Application No. (unknown), entitled, "External Repair Of A Computer," filed February 11, 2002, naming Kenneth Largman and Anthony B. More and Jeffrey Blair as inventors, with Attorney Docket No. A-70543-2/RMA/LM, and commonly assigned to Self Repairing Computers, Inc., San Francisco, California.

U.S. Patent Application Nos. 60/291767, 09/862,898, (unknown) filed November 19, 2001, and (unknown) filed February 11, 2002 are incorporated by reference herein.

U.S. Provisional Patent Applications No. 60/291767 is incorporated by reference herein. U.S. Provisional Patent Application No. 60/291767, entitled, "A Self-Repairing Computer," filed May 17, 2001, naming Kenneth Largman and Anthony B. More as inventors, with Attorney Docket No. P-70543/RMA/LM, and commonly assigned to Self Repairing Computers, Inc., San Francisco, California.

The invention may backup, maintain backups, or recover data associated with a computing system. The computing system may include any number of components including hardware and software, and any memory accessible to the computing system. The computing system may focus on a user computing system and potentially the supporting environment which stabilizes the functionality of the user computing system (e.g.,operating system, BIOS, etc.). Typically data associated with the computing system is identified by a variety of characteristics,

the data is stored as a backup, and subsequently data within the backup may be restored or used to evaluate an existing computing system.

Backups

Data has a number of characteristics, typically including availability for use in a computing system. Data may include one of more of any of the following: operating systems, application, user data, data residing in the computing system (e.g.,hard disk, hard disk partition, RAM, ROM, BIOS, CMOS, EPROM, electronic serial numbers, etc.), applications residing in the computing system (e.g.,sample listed above), and backups created or accessible. The term data may be used to describe a specific aspect of information for association with a backup process. A backup process may include identifying data and the characteristics of data, for backup, management, or restoration. Data may also refer to a backup or set of backups. By default the data to backup may represent all data on a given disk drive, a given disk partition, or a memory.

Characteristics of the data may include an indication of what data is part of the backup, how to access the data, where to backup the data, frequency of the backup, and type of backup. These characteristics may be used to define or identify specific data associated with a backup process. Specific implementations may vary according to what characteristics are associated with the backup process.

What data to include is limited by the accessibility of the data to the computing system. Specific data for inclusion in a backup may be predetermined or determined as part of the backup process. Predetermined identification of data to include in a given backup may be provided by a hardware or software manufacturer, or a user (e.g.,system administrator). Predetermined set of data may provide an initial indication of what data to backup. An operating system may, for example, include a list of files and or directories associated with operating system functionality. Here the operating system may provide a predetermined list of files or associated data representing the operating system or identifying specific data to backup (e.g.,list of uses, user preferences, passwords, windows registry file).

A hardware system may, for example, include a memory address range (e.g.,RAM, ROM, EPROM, BIOS, etc.) that represents data that may be useful to backup for that system. The

hardware system may also identify other data within the computing system that may be useful in the backup process (e.g., applications to extract or update a BIOS). Typically, the data identified is useful in the backup process, such as understanding the operation of the computing system or restoring data in the event of a failure or corrupted data. Data identified for backup may also have a variety of uses including cleaning up the computing system which may have limited disk space (e.g.,verify the necessity of data in a current computing system) and restoring identified data.

Alternatively, what data to include in a given backup may be determined subsequent to the delivery of a computing system to a user. Data may be determined with installation of hardware or software, or during the normal course of utilizing the computing system. A determination may be made with the installation of hardware or software. The installation process may be actively engaged in identifying what data would be useful to the backup process. The installation process may interact with the backup process or tools to identify program files and data specific to a given installation. The location of user file may also be helpful to the backup process. The contents of a user directory may be marked by the backup process for inclusion in a periodic backup. Accessing data by an application may also be integrated into the backup process. One example includes added functionality, such that saving data (e.g.,a files) by the application includes an indication to the backup process to backup that specific data. The installed application may add the saved user file to a list of files that should be include in a subsequent backup. If multiple users access the same computing system, the file to be included in a backup may include an ownership indication.

Data to include may be identified according to directories or specific files. For example, data to include may be identified by file type, file location, directory tree, of memory device. A selective backup may backup only data associated with a specific system component such as a disk drive or data storage device.

How to access the data may be an important characteristic of the backup. An important consideration may be required for accessing, storing, formatting, modifying, restoring, and updating data of the various components associated with a computing system. Not all data is readily accessible according to a well known process of accessing a hard drive. As described above, data may include any data accessible to the computing system. Typically, a piece of data

is uniquely accessible according to a predefined process. The process for accessing information from a disk drive is readily appreciated by novice users.

For example, accessing BIOS data for backup may involve booting into a particular operating system (e.g.,DOS 5.x), running a hardware-specific program which may verify the hardware compatibility, executing a second hardware-specific program which may copy the data (e.g.,BIOS data) to a floppy disk. Updating the BIOS in the example may involve running another program to flash the BIOS. Both the old and new versions of the BIOS, and associated applications can be stored as data in a backup. Consequently, a restoration of the old BIOS can be incorporated into the backup process. Similarly, other data accessible to the computing system may be incorporated in to the backup process by analyzing the existing processes for managing data for specific components within the computing system.

Where a backup is stored may be predetermined or determined as part of the backup process. A manufacturer of the hardware or software may provide an initial predetermined backup storage area or an indication of another device where the backup is to be stored. An operating system may access a second data storage device such as a disk drive, a second partition, or a pre-allocated file (e.g.,similar to a swap file). Backup data may be stored to this initial location. A Hardware system may, for example, include a second memory or an address range of a memory (e.g.,RAM, ROM, EPROM, BIOS, etc.) that represents the default backup location. Optionally, the backup location may be another storage device within the computing system or accessible to the computing system (e.g.,across an Ethernet, firewire, USB, etc.).

Frequency of the backup can be based on any of a number of factors associated with the data and computing system including: volatility of data, volatility of the computing system, importance, upgrade schedule, user projects, personal comfort level, past experience with similar environments, degree of user participation, etc. Backups can be scheduled at particular times and intervals based on these factors. Backups may be initiated by the hardware, software, or a user. Similarly, other activities on the backup process, such as maintenance and restoration, may be performed based on a given frequency.

Type of backup

A variety of backup types may be supported. The types may include at least one of the

following: full backup, selective backup, partial backup, master template, data modified since a prior backup, or based in part on a comparison with a prior backup (e.g.,a prior backup, or a listing of the contents of a prior backup). The type of backup may be defined for all data included in the backup, or part of the data associated with the backup process. For example, a backup may include an operating system wherein only files associated with the operating system and files modified since a prior backup are included in a specific backup. The specific backup may further include a user data directory identified for backup.

Data represented in a backup

Data represented in a backup may be identified by the various characteristics described above. Typically, data represented in a backup supports a backup process, such as a possible restoration of the data for use in a computing system. The backup or the various data contained in the backup may be a compressed or encrypted. Specific data in the backup may be an exact duplicate or enough information that the data may be recreated, corrected, or verified. For example, file differences may be included in a backup, thereby allowing a set of backups to be utilized to recreate or correct a file or data. How to access the data may also be represented in a backup for certain types of data (e.g.,BIOS) and not represented in a backup for other types of data (e.g.,"c:\my docs*.docs").

Data to be included in a given backup may identify by hardware, software, user, or other characteristic of the computing system. A computer manufacturer may create an initial backup of a standard installation, which may include various forms of data associated with a computing system. The manufacturer sells the computing system to a user and may provide a master template as a backup that represents the manufacturers initial computing system configuration. This saves the manufacturer time and money, and gives the user peace of mind. Subsequently the user may install additional software and thereafter create a partial backup of the changes to the computing system. A comparison may be performed between the master template and data associated with the current computing system. Difference between the two can be identified as the data for backup. Here, data that has been changed, added, or deleted, in comparison to data associated with a master template may be identified for backup. Consequently, the master

template and a subsequent backup may be used, according to this example, to restore the computing system to the level of functionality associated with the subsequent backups. A variety of scenarios will be apparent to one skilled in the art.

Repair Process

Restoring

Data represented in a backup is typically restored to a computing system. Restoration may include the selection of at least one of the following: specific backup, group of backups, specific data contained within a backup, and a master template. The restoration may initially determine the difference between the current computing system and a prior backup. Characteristic associated with the identified data may be used in the backup process (e.g.,restoration process associated with BIOS which may have been included in a backup.).

The selection of a master template, for example, may return the computing system to an idealized state as defined by the master template. A master template and other data may be identified to restore the computing system to a state associated with the last backup in combination with the identified master template (e.g.,master template represent the state as purchased, and the identified backup represents the state after a user installed several applications). Alternatively, a master template may represent an upgrade to the computing system. This upgrade may be combined with other user backup to enhance the functionality of the computing system and maintain existing user data.

Selecting Data

Data associated with the backup may be identified similarly to the selection of data for inclusion in the backup, as described above. This information may also be utilized to determine what data or aspects of the data to restore (e.g., specific users files).

Data matching a certain file type, file location, data storage device, device, component, description, date, wild card matching, etc. may be identified for restoration. The selection may be performed by the hardware, software, user, or any component in the computing system. In the event of an operating system failure it may be more appropriate to allow hardware or software select data to restore.

Restoration location for data may be specified by a user, hardware, software, default, original location of the data, temporary location, an alternate location (e.g.,for further analysis), or by any component of the computing system. For example, a user may elect to restore data with wild cards such as "*.doc" and "*.txt" from all backups. The "*.doc" files will be placed in a user-specified or default file location (e.g.,"c:\documents folder\doc\"), and "*.txt" files will be placed in a user specified file location (e.g.,"c:\documents folder\txt\"). Alternatively, the data (e.g.,files in this example) may be restored to their original location which may be identified in the backup.

Preferences

Preferences may be associated with the backup process, and may include preferences of hardware, software, users or other components of a computing system. Preference may be defined as a set of default values associated with the computing system, hardware, software, or particular users. Configuration information and characteristics may be defined as preferences for each component of the computing system. A preference associated with a BIOS may include a process or program for accessing the BIOS in a specific manner, such as booting to DOS 5.x, executing a specific program to extract the BIOS. Preference may be changed by hardware, software, or users.

The preferences can be used to define data characteristics (including backups), restore characteristics, and manage data. Preferences may limit the interaction required with users during the backup process (e.g.,selecting data or restoring data). A new user may establish preferences to limit interaction with a backup process. A seasoned veteran may establish preferences to provide a more robust control of the backup process or aspects of the backup process.

For example, the specific characteristics of how the backup process interacts with updating a BIOS may be of a greater interest to an experienced user rather than a novice. In another example, user preferences may dictate the interaction between the user and the restore. By default, the restoration process my provide the user with a push button restore, such that the computing system will control the entire restoration process. Alternative, the user may modify the preference such that a user response is required before specific aspects of the backup process are performed (e.g.,format hard drive, or flash the BIOS).

Software may also have preferences, which may identify data associated with the software, when installed, serial number, and possibly an indication of the best way to backup, manage, and restore the software. Preferably, preference associated with hardware and software would minimize interaction required a by user in the process.

Initiating Restoration

The hardware, software, or user may initiate and may manage the repair process. Data matching a restoration criteria may be restored. Criteria for restoration may be base on the data stored in the backup (e.g., frequency, master template, compression, encryption, etc.). Further criteria for restoration may be based in part on the type of backup or current status of the computing system (e.g.,functional, hard disk failure, BIOS failure, OS non-responsive, etc.) The current status may be determined in part through the utilization of hardware and software to monitor the health of the computing system. For example, hardware or software can monitor the computing system for any indication of a keyboard "freeze", and activate part of the backup process to return the computing system to a normal operating state. Utilization of hardware and software can be used to maintain the health of the computing system. Maintaining the health of a computing system may include determining backup process characteristics which may be based on user preferences. The frequence of backup may be a way to help ensure the computing system's health.

For example, an alternate boot sequence may be initially established in the BIOS such that the computing system initially attempts to boot from a primary disk drive and subsequently to a second drive. The second drive may contain software designed to boot the machine and evaluate the present condition of the computing system. Once the necessity of any repairs have been determined, the software may proceed to correct the malfunctions and return the computing system to a normal operating state. The software may then reboot the computing system to the normal operating state, thereby minimizing user involvement in the repair process.

Removing Data

During a restoration, process data may be removed including: deleted, moved, renamed, or altered. The method of removal may be specified as part of the data characteristics. The

restoration process may require the computing system to reflect the data contained in a backup, and therefore necessitate the removal of some data. For example, in restoring data representative of an operating system, a preference may provide that existing inconsistent files may represent the culprits behind a malfunction predicating the restore process. Removing this additional data (files in this example) may be warranted. Removing extraneous data may be performed in a number of ways based in part on the type of restoration, preferences, characteristics of the backup or data, and the goals of the backup process (e.g., minimal user involvement). For example, if the goal is to restore the master template, then as part of a comparative restoration all data determined to be different from the master template may be removed to a specified data storage device or memory such as a default folder.

Restore Specific Data

The hardware, software, or user of a computer system may request the restoration of data. To facilitate the restoration of specific data a user may perform a restore based in part on: file type, creation date, user identification, modification data, backup date, or any characteristics of the data. For example, a completed restore may include a default folder that contains all data from the last backup which differs from data currently available for access to the computing system or some subset of all of the data (e.g.,specified according to preferences). Alternatively, the folder may contain all data which differs when comparing two backups, such as the last backup and a master template. Data conforming to the users request may be sorted into different directories to provide the user with an indication of the information contained therein, such as "This is probably your stuff 2/25/03", "Is any of this your stuff? 2/25/03", and "Probably not your stuff2/25/03".

Managing Restored Data

Preferences may also control what happens to restored data. Data restored may be available to the user or the computing system for a limited duration, to reduce the amount of memory utilized by the computing system. For example a user definable preference may indicate that a dialog warning that the folders named "Is any of this your stuff?2/25/03" and "Probably not your stuff2/25/03" will be automatically deleted in 10 days and if the user desires

data from those folders the data should be moved prior to the expiration date. Optionally, a preference may provide that after 10 days the contents specific folders may be moved to a temporary "trash" folder with a new expiration date of 30 days.

Placement of restored data

Placement of data may be defined in part by the data characteristics stored with the backup or data, the characteristics associated with the backup process, and the preferences. Data, such as user data, may be returned to an original location, and other data may be placed in a different location. For example, user data located on the desktop may be returned to where it was, whereas user data located in the system folder may be returned to its original location depending in part on preferences. Alternatively, user data may be deposited in a default or indicated location such as a "documents" folder, a "Your Stuff is In Here" folder, a "proposed trash" folder, a "trash" folder, or other custom locations.

Master Templates

A master template is a backup of data, representing a computing system according to an ideal state. The ideal state typically includes an operating system, a collection of applications or software. The data included in the master template may have been specifically chosen for a particular user and for a particular hardware configuration.

A master template may be created or updated according to a variety of approaches. One approaches involving a data storage device may include: 1. Creating several backups of data on a data storage device over time; 2. An activity associated with the backup process, such as a repair process is triggered; 3. A backup of user data files is performed (e.g.,to save the users current work) ; 4. Existing data storage device (e.g.,memory) may be reformatted or tested, and may be performed according to preferences for that data storage device; 5. The master template is copied to the user data storage device; 6. Backup of user data files is restored to the user data storage device. 7. The computing system is thereby restored to a normal operating state with minimal user intervention.

The master template may also be updated, changed, or modified in a variety of ways including: by the user, by access to an update (e.g.,an incremental release by a computer

manufacture), or by access to a replacement master template, etc. The preferences associated with a master template may provide a method for performing these modification.

The master template may be tested to ensure the master template and the repair process functions as expected in the backup process, such as restoring the computing system This testing helps ensure the functionality of the master template, the restore process, and may also be used as a virus check and repair. An on-line service may be provided to detect virus, verify the integrity, or to update a master template.

Restoring

A backup may be tested to verify its integrity (e.g.,with a checksum and verifying readability). If the backup is tested and fails, the user may change the preferences. The user may restart the repair process, select different preferences (e.g.,applications or software), upgrade the backup (e.g.,master template), and retest the backup. If the backup passes the verification tests, the user may accept the backup and continue with the restore. When a backup (e.g.,master template) is accepted it can be copied from its storage location to a second backup (e.g.,the new master template). The old master template(s) can be saved so that it is possible to revert back to prior master templates. After the user template is "accepted", the backup user data is returned to the user data storage device.

In one embodiment, a master template can be created by the user selecting to "boot into" a master template. The user may then make changes, install new software, make modifications, etc., and then exit. This approach allows the master template to be updated independently of user's documents and other data which may not be a beneficial to a master template.

In a different embodiment, the master template may be modified/updated by the user first conducting a repair of computing system. The repair process may automate 1. The backup of user files according to preferences, potentially including particular file types (e.g.,documents); 2. the reformat of the user's primary disk drive or the restoring of the master template to the user's primary disk drive. The user may then install new software to an essential copy of the master template as present on the user's primary disk drive. A backup may subsequently be activated to

generate a new master template version. A backup of the user's data (e.g.,user specific documents) may then be restored to the computing system. Preferably, restoring the user specific documents is performed automatically.

The master template may be created by a process of selective copying. For example, depending on the particular OS in use, a program may interrogate the registry, determine what entries are associated with a particular program or application, and then choose to selectively copy only those files and entries associated with the particular program or application to the master template.

The foregoing descriptions of specific embodiments and best mode of the present invention have been presented for purposes of illustration and description. They are not intended to be exhaustive or to limit the invention to the precise forms disclosed, and obviously many modifications and variations are possible in light of the above teaching. The embodiments were chosen and described in order to best explain the principles of the invention and its practical application, to thereby enable others skilled in the art to best utilize the invention and various embodiments with various modifications as are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the claims appended hereto and their equivalents.

This description includes and incorporates the three Appendices which follow: Appendix A, Appendix B, and Appendix C. Appendix A itself refers to an Appendix. That referenced Appendix is a sub-Appendix within Appendix A.